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THE CLOUD UNIVERSITY PLATFORM: NEW CHALLENGES OF THE CO-OPERATION IN THE EUROPEAN UNIVERSITY SYSTEM

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Abstract

Many experts have recently noted that cloud computing is a key driver of digital technology and ubiquitous revolution. Cloud computing is Internet-based computing, whereby shared resources, software, and information are provided to computers and other devices on demand, like the electricity grid.

In the paper we concentrate on "clouds" in the context of universities. The aim of paper is to create the conceptual framework of the cloud university platform.

The concept of European Cloud University is a new idea to make universities to be more competitive in a global setting and provide a broad set of educational services to customers. It provides a large-scale platform for exchange of information, views, mutual learning and practical cooperation between innovation policy and innovation support actors with an interest in, and willingness to contribute to the improvement of the design, implementation and delivery of innovation policies and support measures.

Keywords: Universities, co-operation, Europe, innovation systems, open innovation paradigm, ecosystems of innovation, cloud computing, innovation dynamics, life long learning.

Introduction

In this article we shall discuss about future challenges of European university co-operation. Many experts have recently noted that cloud computing is a key driver of digital technology and ubiquitous revolution. Cloud computing is Internet-based computing, whereby shared resources, software, and information are provided to computers and other devices on demand, like the (1) electricity grid (smart grids in general), (2) smart buildings and housing systems and (3) location and navigation systems.

In the paper we concentrate on "clouds" in the context of universities. The aim of paper is to create the conceptual framework of the cloud university platform. Our study is based on broad literature review and desk work and grounded theory. The research target of this article is to open the future oriented concepts and the novel research discourse of the Cloud University. The views and results, which are presented here in this article, are based on open and selective coding analyses (see Potter 1996, Strauss and Corbin 1998, Glaser 2008). Later we plan to extend our study to more complex analyses like conditional matrix analyses.

The concept of European Cloud University is a new idea to make universities to be more competitive in a global setting and provide a broad set of educational services to customers. It provides a large-scale platform for exchange of information, views, mutual learning and practical cooperation between innovation policy and innovation support actors with an interest in, and willingness to contribute to the improvement of the design, implementation and delivery of innovation policies and support measures.

The interaction between innovation, entrepreneurship and regional economic development has become a central theme in many policy circles. Recently, the penetration of utilitarian arguments into governments' university policy has been so intensive that even the concept of scientific curiosity has been replaced by the concepts of innovation and entrepreneurial attitude. The new phenomenon of entrepreneurial universities has received considerable attention over the last decades. An entrepreneurial orientation by academia might put regions and nations in an advantageous position in emerging knowledge-intensive fields of economic activity. At the same time, such entrepreneurial orientation requires reconciliation with the scientific visions, missions of academia (see e.g. Baumol 2002).

In the political context, the concept of innovation refers now to a process where all producers of knowledge are involved in every phase of an innovation chain, i.e. from the production of knowledge to its marketing and commercialization. Universities can play a critical role both in supply driven innovation and demand driven innovations. There has also been pressure on the universities to redefine their strategic goals, core values and missions in order to demonstrate their contribution to economic progress and social welfare, and their value as a public investment.

A closer look reveals a multiplicity of visions and prospects of the future that are driven by highly advanced innovations and technologies. In a way the visions are based on social theory as a plenty of references has been made to some "postmodern" elements of socio-economic change. In particular the political views of "the information society" or "knowledge society" (Blair, 1998, Sitra, 1998) and "the globalizing learning economy" (European Commission 1998) have served as syntheses of the new technology-intensive social, economic and human progress. Key forms of innovation are technological innovations, business innovations and social innovations. Today innovation should be considered as a dynamic process referring to above three-dimensional knowledge system. Innovation processes have

extremely complex composition and mechanism.

Traditionally, there have been two dominant approaches in innovation theories: (1) Technology push approach (supply based approach) and (2) Demand-pull approach (demand based approach). According to the traditional supply-based approach, the so-called linear model assumes that innovations can be advanced in an organized manner and systematically. By demand based innovations we mean that users, customers, and different actors are interactively connected into making innovations. Viewed from this perspective, the advancement of innovations does not necessarily follow any clear and phased logic but develops contextually and is problem-related, inductive, and dependent on interrelationships. The ecosystem of an innovation represents in the research project an approach that can be utilized for analyzing and developing dynamic and customer-oriented innovations. The approach related to the ecosystem of innovations contains a potential, which enables the implementation of European research and innovation policies more convincingly.

By innovations ecosystem we mean the approach where the objective is to specify the factors that affect the generation and development of innovations taking into account adaptation into the operating environment. In a complex environment, a functional ecosystem contains, firstly, actors that utilize innovations, such as entrepreneurs and actors of the public sector, and, secondly, modes of operation that promote dynamism and self-steering, such as interaction and network structures based on openness, and practices that promote social activities (e.g. social media). In addition, ecosystem includes the structures supporting it. These include especially universities and research institutions. Ecosystems are both local and global.

According to Finnish innovation policy expert, Prof. Hautamäki, the best "innovation ecosystems" are local, dynamic and open environments in which there is top-level research, adequate funding for new competence-based companies, high-standard business services, a skilled workforce and a diverse set of enterprises. Most importantly, however, this "ecosystem" would nurture creativity, encouraging experimentation and risk taking and close cooperation between different actors, especially international actors. Innovation activities are no longer an internal matter for companies. They have been partly outsourced and distributed. Innovations are created in collaboration with clients, end-users, research institutes and other enterprises (Hautamäki 2008).

Knowledge is a pre-condition to an innovation. Innovation is equal to applications of a new idea or a new application of an existing idea. It is not just in high tech, manufacture, private sector, but in low tech, service, public and private sector. Innovation refers to all discipline fields: not only based and depend on natural science and technology, but also on social science and technology. (Moulaert and Sekia 2003).

Albeit often gradually, the roles that universities undertake in society change and evolve over time. "The medieval university looked backwards; it professed to be a storehouse of old knowledge . . . The modern university looks forward, and is a factory of new knowledge." So wrote the English biologist Thomas Henry Huxley in 1892, remarking on the transformation that industrial society had stimulated in long-established functions of universities. This kind of evolutionary process will also take place in the future. Evolution in the role of universities is proceeding from knowledge storehouse (mode 1) to knowledge factory (mode 2) to knowledge hub (mode 3) and finally to innovation factories (4). Universities are not ivory towers, but they are innovation engines and learning environments in contemporary societies (Carayannis & Campbell 2006, Mowery et al).

In the next chapters we discuss more about future prospects of European universities. Our focus in on innovation processes of the European universities. We also discuss shortly about strategic lifelong learning role of the European universities.

New dynamics of European innovation systems

Recently, Prahalad and Krishnan reveal that the key to value creation and future growth of every business depend on having access to global resource networks that co-create unique experiences with customers. This idea of global resource networks is a key element in the innovation ecosystem thinking. It is worth of thinking in the policy context of managing European universities. (Prahalad and Krishnan 2008).

The more systemic view of the innovation process recognizes the potentially complex interdependencies between the elements of the innovation process. The chain-linked model makes it evident that the systems-oriented approach accords great importance to the demand side. It has been shown that many users – both individuals and firms – develop new products and services to serve their own needs. The so-called customer-driven innovation process is increasingly relevant for many companies. Technological progress has made this kind of innovation model easier and more feasible for larger segments of population. User-innovators and open innovation models will probably change the logic of innovation systems in the future. As stated above, open innovation is a new paradigm for managing research, technology, R&D, and business. Many companies have opened their innovation processes and successfully utilize open innovation strategies. Knowledge society is internationally networked. The well being of Europeans depends on what the customers in China choose today, and what the factories in Brazil make tomorrow. Also creative class is more and more international. A strategy for globalization is therefore an integral part of the European knowledge society strategy. (Florida 2002, von Hippel 2005, Baldwin, Hienerth and von Hippel 2006, Chesbrough,, Vanhaverbek and West 2008). Today we can start talking about national open innovation systems,l about NOIS paradigm (see Freeman 1995, Santonen, Kaivo-oja and Suomala 2007).

Global networking is becoming increasingly easy. Strategic investments are needed to grasp this opportunity. European universities probably need to think of globalization as a challenge and, accordingly, of global investments and the networking of universities. Europe must strengthen its global competitiveness in higher education, research, and innovation.

We are moving from an information society towards a ubiquitous society. Ubiqueis Latin for 'everywhere.' The "ubiquitousness" of our near future means that information technology decreases in physical size and spreads out to all possible everyday situations. The relationship between man and machine is slowly transforming into a relationship between man and his technological environment. This

development is substantially affected by the future of the Internet; Web 2.0 and 3.0 (Internet of Things). We anticipate that in 2030 everyday objects, such as refrigerators, clocks and e-cars, are connected to the Internet. For example, a smart refrigerator is able to make sure that it contains all the necessary groceries according to predefined parameters. (see e.g. Kurzweil 1990). Many similar kind of technological applications will be invented.

We can expect that Internet of Things, Web 2.0 and Web 3.0, Cloud computing systems and fast expansion of social media will change organizational logic of European universities (see e.g. Cachia , Compano and De Costa 2007). Probably after social media we can start talking about ubi-media although other form of media (broadcasting media, interactive media and social media) will exist in the communication, news and media markets.

Ubiquitous refers to pervasive, embedded information technology that works imperceptibly. The term 'ubiquitous computing' was first defined in the late 1980s by Mark Weiser of the Xerox laboratory. The goal was to achieve technology with such a subtle, easy-to-use presence that it goes unnoticed. Discussions on ubiquitous society involve such concepts as "smart" spaces and materials and mediated built environments. A smart space refers to the interaction between man, computer and the built environment. "Smart" is in quotes, naturally, for we are not dealing with intelligence per se. A "smart" space is not an independent cognitive entity. "The emerging relationship between people and pervasive computation is sometimes idealized as a 'smart space': the seamless integration of people, computation, and physical reality." (Weiser 1991).

The concept of European Cloud University is a new idea to make European universities to be more competitive in a global setting and provide a broad set of educational services to global customers and European citizens. European universities and research institutes are vitally important in this context. The development of these European institutions primarily requires action within the national and regional systems for higher education, science, and research in order to provide adequate funding and favorable framework conditions.

Without pilot experiments transition process will be more difficult than in a situation where piloting activities are made in a large scale. University reform should be supported by cross-border cooperation and action at the European level. The agenda for modernizing European universities is a fundamental part of new innovation ecosystems. (Aho 2006, Brinkley 2008).

The cloud university platform

The fundamental concept of cloud computing is that the computing is "in the cloud" i.e. the processing (and the related data) is not in a specified, known or static place(s). This is in opposition to where the processing takes place in one or more specific servers that are known. Cloud computing provides a new platform for the European Universities. All the other concepts mentioned are supplementary or complementary to this concept.

Generally, cloud computing customers do not own the physical infrastructure, instead avoiding capital expenditure by renting usage from a third-party provider. European Cloud University could provide a new possibility of distant work and education. They consume resources as a service and pay only for resources that they use. Many cloud-computing offerings employ the utility computing model, which is analogous to how traditional utility services (such as electricity) are consumed, whereas others bill on a subscription basis.

Sharing "perishable and intangible" computing power among multiple tenants can improve utilization rates, as servers are not unnecessarily left idle, which can reduce costs significantly while increasing the speed of application development. A side-effect of this approach is that overall computer usage rises dramatically, as customers do not have to engineer for peak load limits. In addition, "increased high-speed bandwidth" makes it possible to receive the same. The cloud is becoming increasingly associated with small and medium enterprises (SMEs) as in many cases they cannot justify or afford the large capital expenditure of traditional IT.

SMEs, citizens and public agencies also typically have less existing infrastructure, less bureaucracy, more flexibility, and smaller capital budgets for purchasing in-house technology. Similarly, SMEs in emerging markets are typically unburdened by established legacy infrastructures, thus reducing the complexity of deploying cloud solutions

In contemporary societies, universities have three main functions. Through science, technology, and innovation (STI), universities (1) are working to provide research achievements needed in the society, (2) promote different modes of technology transfer to promote productivity, and (3) realize the universities' mission of talent education and social service. These functions of universities are strategically very important for the competitiveness of Europe. On the one hand, universities must strengthen their capability of scientific research innovation, produce first-rate research achievements that can be recognized internationally; on the other hand,

European universities need to transform research achievements into practical productivity, make full use of them in the industrial and service sectors and in the public sector. In doing so, universities utilize extensive social and economic resources, which not only promote social development, but also raise more funds and absorb more resources for themselves, and enhance their economic strength.

Cloud concept allows for joining two or more elements in order to perform a more complicated, bigger task than available for a single one and keep the structure easily reconfigurable, flexible and agile – in the area of three key university functions.

The theoretical platform is the systematic innovation theory (innovation ecosystems and social innovations) combined with creativity and open innovation approach (Phills, Deiglmeier and Miller 2008). The growth of knowledge has accelerated in recent years and bright minds clustered in the right environments could spark a knowledge revolution and knowledge societies. According to the Lisbon strategy and post-Lisbon developments, Europe tries to become a leading knowledge society. The future Internet, which will see full integration of infrastructure and user services, is now a key driver of the networked digital economy. The core of knowledge society is its system of learning. When the processes of knowledge production and appropriation change the system of learning will also change. Education is rapidly becoming international and intertwined

into individual life careers. The historical role of European universities as institutions of knowledge production is about to change. It should not be impossible to think that the system of education in the next decade should look quite different from what it is today. A new system of learning and inventing is about to emerge, and what will it do and what will it will look like will depend on us.

Sustainability challenge

In many strategies of the European Commission Information and Communications Technologies (ICT) cluster is seen to be one policy instrument promoting development towards sustainability. In these strategies key idea is that the mobilizations of ICTs facilitate the transition to an energy-efficient, low-carbon economy, and also to better sustainability.

The Cloud University platform can be an effective tool to (1) promote the use of nature saving technologies, (2) improve ecological land use and sustainable transportation systems, and (3) raise awareness of more sustainable lifestyles. These kinds of political sustainability targets can be integrated to the Cloud University Platform.

The use of modern ICTs can increase dematerialization of production and immaterialization of consumption (see e.g. Jokinen, Malaska and Kaivo-oja 1998).

In general, knowledge and learning are fundamental component of sustainable economic growth and welfare. Learning processes typically are built on trust and social capital. Institutions that are able to imbue these elements into firms and markets encourage interactive learning and are more likely to produce strong innovative capabilities. (Archibugi and Lundvall 2001). From the social and economic trust perspective it is very important to eliminate all possible security and privacy risks of the cloud university system.

Future challenges of European university co-operation

International competitiveness and macroeconomic performance are functions of innovation-based commerce and long-term innovation abilities. Different innovations may require quite different organizational efforts and may result in a multitude of competitive impacts. From this perspective, innovation types can be categorized into two classes: incremental and disruptive innovations. Incremental innovations utilize current technology in the market to strengthen existing competencies. This type of innovation generates value by accumulative effect and by creating versatility. Disruptive innovations frequently begin in limited markets, but, after technological improvements, they substitute current technologies and simplify the product and the value proposition. (Dosi 1982, Abernathy and Clark 1985).

Innovation begins with ideas, but ideas need to be transformed into useful commercial and social outcomes. An innovation ecosystem model encompasses more than knowledge inputs and incorporates all relevant factors and stakeholders that generate value to customers. The importance of software technologies is increasing. Software has a special role because it is the technology that is used to implement the new forms of social and societal practice. A profound understanding of software technologies is a critical success factor of the knowledge society (including European universities). In the global economy the commercialization of innovations will be an increasingly central source of value. Knowledge economy is an innovation economy. This has already become visible in the fact that employment growth has focused on young well-educated workers. A highly evolved innovation ecosystem enables participants to work across company boundaries, focus on customer value creation, respond quickly and with agility to shifts in market demand, accelerate the transition from research to production, and be more adaptive to change. Innovation ecosystems build a collaborative advantage and a strategic asset for economic growth and profitability in the years ahead.

The scheme of the national innovation ecosystem proposed by the Council on Competitiveness includes the following propositions (see Council on Competitiveness 1987, Watanabe and Fukuda 2005):

- Innovation is much more than technology — many additional resources and services are essential for market success;
- As with human health, there is no single attribute adequate to capture innovation dynamics and multiplicity features;
- The success and diffusion of innovation is ultimately determined by the demand side and not just by technical inputs and product features;
- Firms are beyond the dichotomy of technology push and market pull; they are embracing both sides of the equation by collaborating more closely with customers, associating with external sources of innovation, networking resources into new business models, and focusing innovation on global market opportunities, and
- Non-linear dynamics characterize the entire innovation value chain end-to-end at the national and the firm level.

Top level experts in U.S. and Japan see co-evolutionary development cycle in the following way (Fig. 1, Watanabe and Fukuda 2005, p. 3).

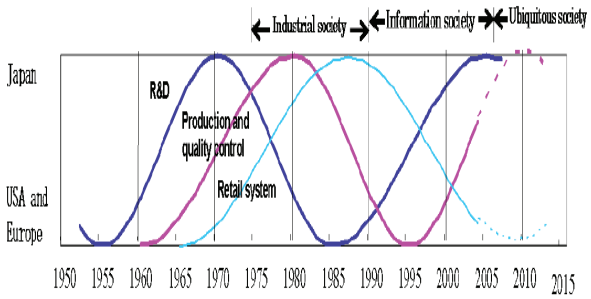

Figure 1. The mutually inspiring co-evolutionary development cycle in Japan and the USA (1950-2010)

Thus, European innovation eco-systems are important to build on fundamental European social innovation advantages. Many innovation advantages are based on long-term socio-technical system development. Also maintaining advantage requires constant assessment, choices and renewal of innovation eco-systems. The Web makes it possible today to

develop deeper relationships with customers by linking the information systems of interacting organizations together in order to reduce or eliminate the time required to react to changing market requirements. Self-organizing systems and network dynamics allows co-operation among dynamic value chains in several industry and service sectors. The Web can help also in consumer-driven innovation processes in Europe, if companies can get relevant weak signals in time from different consumer groups.

The development of innovation ecosystems is a powerful capacity building instrument for implementing a comprehensive European horizontal industrial policy by linking RTD policy (FP7), innovation and support to SMEs (CIP), cohesion policy ("innovation poles", research-driven and industrial clusters, "regions of knowledge"), and international cooperation policy.

The big advantage and public good of European Cloud University is that it provides a lot of possibilities to decrease transaction costs of European University Network. This increases the competiveness of European University system. Also many sustainability benefits can be created by this kind of invention.

Conclusions

We have argued that cloud cniversity is the platform for innovation ecosystem. This means that the concept of Cloud University platform gets contents from innovation ecosystem and its future challenges.

Also modern Triple Helix idea and thinking (co-operation of the Government, the industries and the academia working together) requires agile adoption of modern tools of internet and other digital technology communication tools.

As we have noticed as well that evolution in the role of universities is proceeding from knowledge storehouse to knowledge factory to knowledge hub and finally to innovation factories. Today innovation should be considered as a dynamic process. Innovation processes have extremely complex composition and mechanism.

Innovation ecosystems should build a collaborative advantage and a strategic asset for economic growth and profitability.A highly evolved cloud university platform enable participants to work across company boundaries, focus on customer value creation, respond quickly and with agility to shifts in market demand, accelerate the transition from research to production, and be more adaptive to change.

USA and Japan are now adopting this kind of new approach. Innovation eco-system approach was launched by US National Council of Competitiveness in 2004 (21st Century Innovation Working Group of the Council on Competitiveness 2004). In Japan Industrial Structure Council made similar statement in 2005 (Industrial Structure Council 2005). Especially the emergence of ubiquitous society requires new kind of approach to innovation system management. Paradigm shift from information society to ubiquitous society is obvious and recognized (see e.g. Watanabe and Fukuda 2005)

To sum up, if European Union wants to take ubiquitous technology revolution seriously, broad innovation eco-system thinking must be adopted. European Cloud University model is such a platform, which includes an *innovation eco-system thinking* idea.

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